openreach

SIN 525

Issue 4.2
April 2025

Suppliers' Information Note

For The Openreach Network

Dark Fibre (DF)

Technical Information For Suppliers

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Issued by: Mike Goddard | **Issue:** 4.2 | **Date:** 01/042025

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Introduction and handy reading tip for our customers

1. Introduction

This Technical Document describes the interface provided by the Openreach Dark Fibre (DF) service.

This is an Openreach ancillary document. It contains important information about the Dark Fibre product which our customers ("you") need to understand.

As we introduce or withdraw product features, or otherwise develop our services, we will make changes to this document in line with the Ancillary Document Change Control process documented in clause 17.4 of the Contract except that instead of a minimum of 28 days notification period, a minimum notification period of 90 days will apply.

DF is a single or fibre pair optical point to point fibre link, routed between two permanently connected end points and available 24 hours a day, 365 days a year. DF provides optical fibre links between combinations of end user sites and BT exchanges.

2. Service Outline

DF provides a point-to-point optical path with a maximum route (fibre) distance of 86km between end points.

DF service offers an uncontended, unmonitored optical path which will support optical transmission at user defined wavelengths and user defined bit rates.

2.1. Product Options

The following architectural options are available.

Product Options	**Architectural Options**
Single Fibre	Single fibre on single route
Fibre Pair	Fibre Pair on single route/sheath
Fibre Pair	RO2 – 2x single fibres on diverse routes
Two Fibre Pairs	RO2 – 2x fibre pairs on diverse routes (fibre pairs in seperate sheaths)
One Fibre Pair & One Single Fibre	RO2 – 1x fibre pair and 1x single fibre on diverse routes (one fibre pair in same sheath)

Table 1 Dark Fibre Architectural Configuration Options

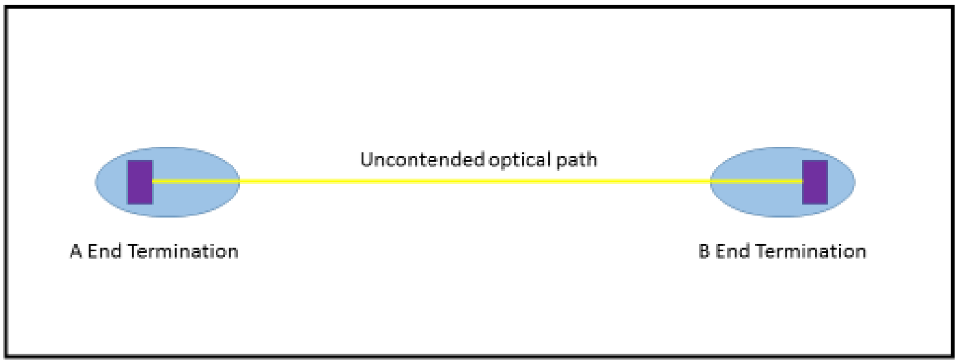

Figure 1 Dark Fibre Architecture: Single Fibre Configuration

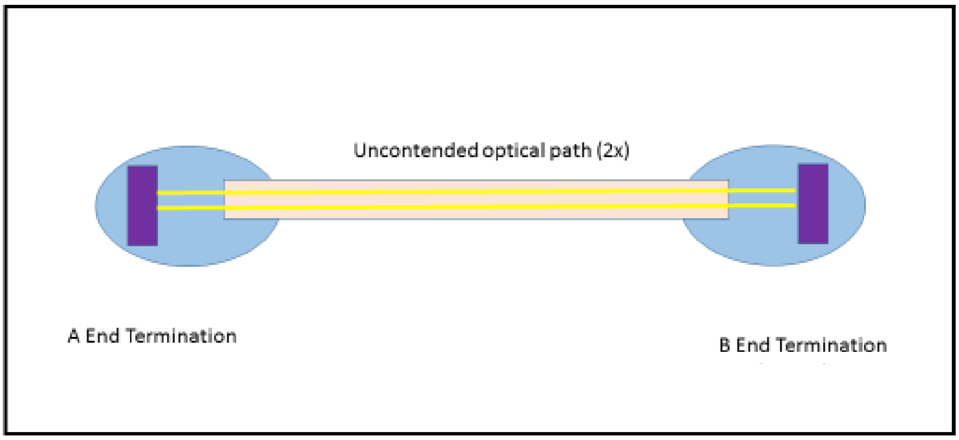
Uncontended optical path (2x)
A End Termination
B End Termination

Figure 2 Dark Fibre Architecture: Fibre Pair on single route/sheath

2.2. RO2: General Principles.

RO2 configuration consists of two diversely routed circuits (i.e. primary and secondary). The circuits can terminate on separate Patch Panels and can be either:

- Diversely routed between the same circuit A-end and B-end termination points
- Diversely routed between different circuit A-end and B-end termination points
- Diversely routed from the same circuit A-end to two different circuit B-end termination points – this is the most common configuration. Diversely routed from the different circuit A-ends to the same circuit B-end termination points.

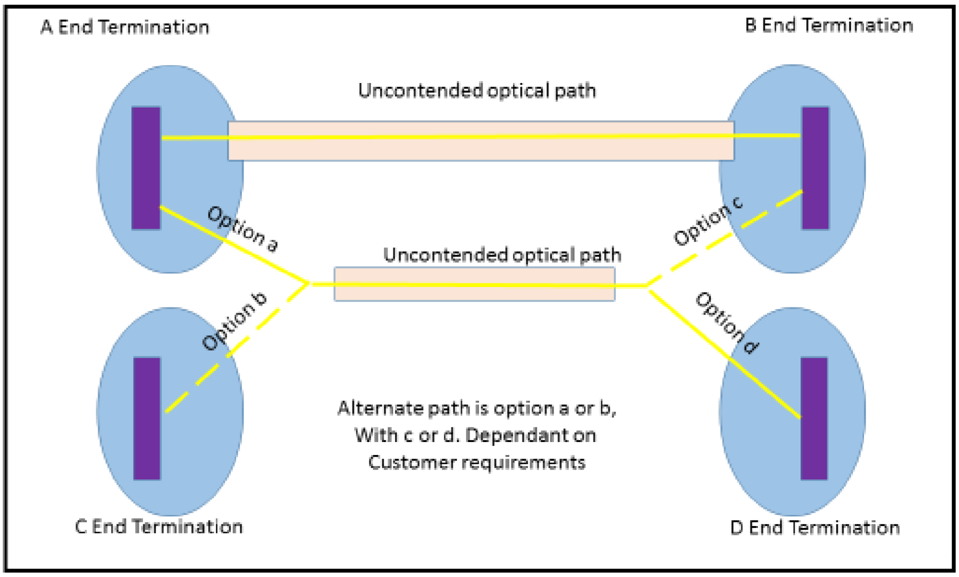
A End Termination
B End Termination
Uncontended optical path
Option a
Option c
Uncontended optical path
Option b
Option d
Alternate path is option a or b,
With c or d. Dependant on
Customer requirements
C End Termination
D End Termination

Figure 3 Dark Fibre Architecture: RO2 – 2x single fibres on diverse routes

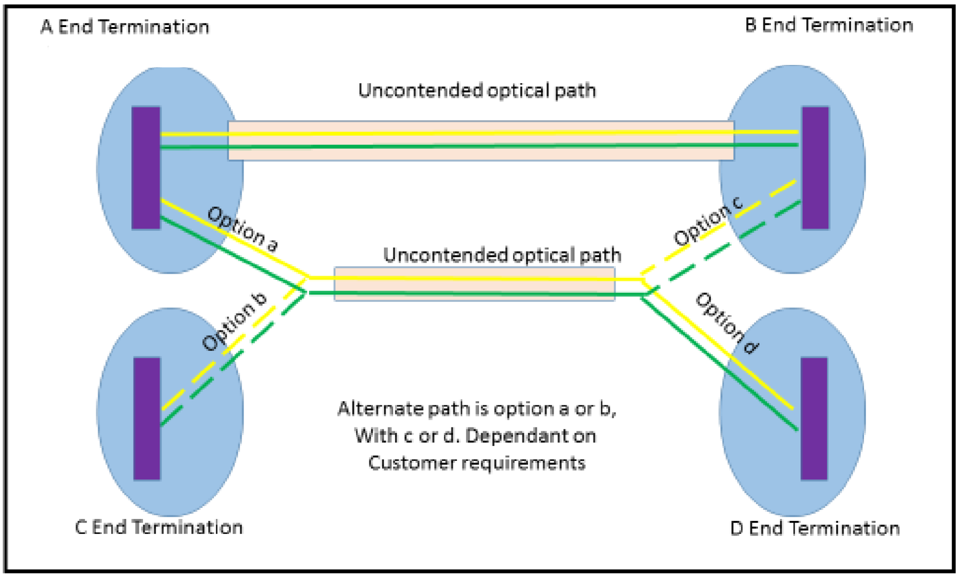
A End Termination
B End Termination
Uncontended optical path
Option a
Option c
Uncontended optical path
Option b
Option d
Alternate path is option a or b,
With c or d. Dependant on
Customer requirements
C End Termination
D End Termination

Figure 4 Dark Fibre Architecture: RO2 – 2x fibre pairs on diverse routes (two fibres in same sheath)

3. Dark Fibre Service Features

- The fibre for any span within the DF service will conform to ITU–T G652.A,B,C or D or G.657A1,A2 with the overall performance of the fibre providing the service meeting or exceeding ITU–T G652.A.
- The DF service will be accessed via optical termination equipment installed by Openreach.
- The point of demarcation for the DF service will be the port on the optical termination equipment supplied by Openreach, for each of the fibres that make up an instance of that service.

3.1. DF: Single fibre on single route

This DF architecture comprises of a single fibre between two agreed endpoints.

3.2. DF: Fibre pair on single route/sheath

This DF architecture comprises of two fibres within the same cable segments along their entire length.

3.3. DF: 2x single fibres on diverse routes

This DF architecture comprises of two fibres. These are within separate cables along their entire length. The services can be between the same pair of termination points or between different termination points at one or both ends.

3.4. DF: 2x fibre pairs on diverse routes (each of the dual routes in same sheath)

This DF architecture comprises of four fibres. Each fibre pair is routed within the same cable segments along their entire length. The two fibre pairs are routed within separate cables along their entire length. The services can be between the same pair of termination points or between different termination points at one or both ends.

3.5. DF: Fibre pair and single fibre on diverse routes

This DF architecture comprises of three fibres. The fibre pair and single fibre are in separate cables along their entire length. The services can be between the same pair of termination points or between different termination at one or both ends.

4. Optical Fibre Specifications

The Fibre for any span within the DF service will conform to ITU–T G652.A,B,C or D or G.657A1,A2 with the overall performance of the fibre providing the service meeting or exceeding ITU–T G652.A.

An optical loss figure will be provided by Openreach for any particular dark fibre service. The loss at build will be specified at both 1310nm and 1550nm.

The following are not measured or controlled as part of the DF service:

- Chromatic Dispersion Compensation
- Polarization mode dispersion (PMD)
- Latency
- The refractive index of the optical fibre (although typically this is approximately 1.47)

Differential optical loss between fibres in a DF fibre pair service will be a maximum of 2dB at 1550nm.

5. Optical Loss for the Dark Fibre Service

Optical loss calculations and measurement will follow Openreach current practice as documented below for its optical infrastructure. All planning and maintenance loss figures will be inclusive of all specific fibre splices and the SC/APC connectors at either end on the fibre patch panels on the DF service.

In order to aid the CP using the DF service, information on the optical loss of the service will be presented in a timely manner as follows:

- The estimated fibre route length for any DF service will be calculated by the fibre planner using cable distances from Openreach inventory systems (INS). The optical path loss will then be calculated by using the route length and planning multiplier of 0.35dB/km at 1310nm and 0.25dB/km at 1550nm. This figure is given to the CP as an estimate of optical loss for each individual fibre end to end at KCI1.1.

- On completion of the planning phase, the fibre route length for any DF service will be confirmed by the fibre planner using cable distances from INS. The optical path loss will then be calculated by using the route length and planning multiplier of 0.35dB/km at 1310nm and 0.25dB/km at 1550nm. These updated figures will be given to the CP as an estimate of optical loss for each individual fibre end to end at KCI1.2.

- At KCI3 the actual length of the optical network is measured using an OTDR (Optical Time-Domain Reflectometer). The optical loss is measured using an OPM (Optical Power Meter) and Light Source (LS). These figures for the DF service will be given to the CP at both 1310nm and 1550nm. All testing will be completed in a single direction.

- The optical loss figures, at which this particular DF service will be considered as faulty (maintenance loss) will be calculated and given to the CP. These loss figures are calculated as follows: the actual (as opposed to planned) route length and maintenance multipliers of 0.5dB/km at 1310nm and 0.35dB/km at 1550nm.

  - Depending on the actual route length, additonal budget will be added to the maintenance loss as per the table below.

	Additional budget (dB)	
Actual Route Length	1310nm	1550nm
0 – 20km	3	3
>20km	2	2

- All planning and maintenance loss figures will be inclusive of all fibre splices and the SC/APC connectors at either end on the fibre patch panels on the DF service.

6. Splice Loss for the Dark Fibre Service

Openreach will undertake reasonable endeavours to ensure splice losses are ≤0.3dB, in accordance with ITU-T L.12 Recommendation. Unless otherwise stated all measurements shall be conducted at the nominal wavelengths of 1310nm and 1550nm.

However, splice losses in excess of 0.3dB may be found if uni-directional measurements are taken with an OTDR. This is due to fibre characteristics, with the OTDR measuring backscatter of these and not the splice itself.

These higher splice losses are acceptable providing that the overall optical performance of the route does not exceed the maintenance loss.

7. Repair (T2R - Trouble to Resolve)

Testing of the DF service will follow Openreach's standard practice as described below for all Optical Fibre within its network.

The CP will have been given a set of actual optical loss figures for the DF Service on commissioning.

The CP will also have been given a set of optical loss figures, for that particular DF service which are deemed by Openreach to be the maximum acceptable optical loss figures for that service. Any loss greater than these values will mean the Openreach optical path is deemed faulty.

It is the responsibility of the CP to notify Openreach when it believes any DF service is faulty. It must pass across to Openreach the Circuit IDs relating to the faulty circuit.

Optionally, the CP may provide an OTDR trace of the faulty fibre, which may reduce the time taken by Openreach to repair the service.

It is necessary for Openreach to access at least one end of the DF service fibres for testing. In the situation where the CP or its agents are unable to help, Openreach engineers will disconnect the optical transmission equipment attached to the fibres in order to perform T2R. It may be necessary for the equipment at both ends of the optical fibre system making up a particular DF service to be disconnected: The Openreach engineer will do this.

Openreach or their agents will test the optical path(s) using test equipment provided by Openreach or their agents.

After testing and repair, Openreach will clean the fibre connectors, reconnect any links they originally disconnected and then hand back the DF service to the CP.

8. Customer Interfaces

The customer interface for the Dark Fibre service will be a number of captive female optical connectors dependent upon Dark Fibre service type.

- It shall be the customer's responsibility to provide a connection from the Openreach optical patch panel into optical transmission equipment owned by the customer for any and each instance of the DF Service.

- The optical connector(s) provided by the customer using the DF service must be of the correct type and quality in order for the DF service to operate correctly.

- The optical connector(s) provided by the customer using the DFX service must be optically clean in order for the Dark Fibre service to operate correctly

- The optical connectors will be of type single SC/APC (BS EN 50377-4-2 (grade B+C))

8.1. Rack Mounted Patch Panel

The Splice and Patch panel is designed to be installed into a 19″ rack. Optionally, the Splice and Patch panel may be fitted instead into an ETSI 535mm rack.

There are two options available:

- 12 port upgradeable to 24 optical port panel.
- 24 port upgradeable to 48 optical port panel.

At customer request, a second panel may be deployed at a site to allow for RO2 services to be delivered with local cable diversity from the Optical Flexibility Frame in that exchange.

Because of restricted outlet space in the Splice and Patch Panels supplies by Openreach, if a CP wishes to load a 48 fibre patch panel beyond 36 fibres, the Customer patch cables must be of diameter 2mm or smaller.

The Splice and Patch Panels are 1U high and utilise SC/APC connectors for service connections.

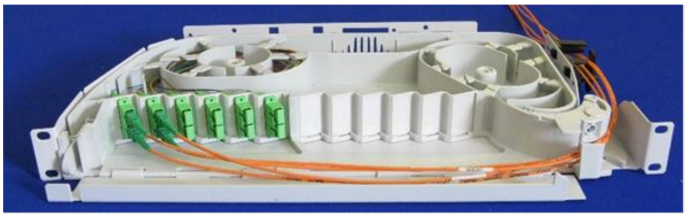

Figure 5 Splice and patch panel

8.2. Wall Mounted Patch Panel

Where space is limited or at a premium a Wall Mounted Box can be used. These wall boxes will accept either cable or BFT.

These will be available in 4 or 8 port configurations with SC/APC optical connectors.

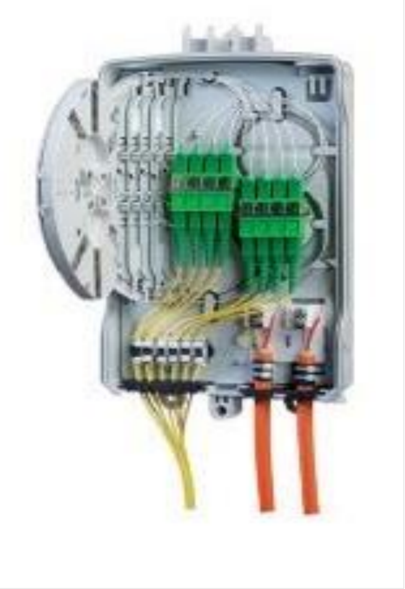

Figure 6 Wall Mount Unit

8.3. Connectorised Block Terminals

Openreach will supply the Corning Connectorised Block Terminal, available in 4, 8 and 12 ports variants.

These are supplied with pre-connected network tails which is suitable to be installed directly into Duct.

Connector interface: Optitap hardened SC/APC female connectors.

Optitap SC/APC patch cable are required to interface to CP equipment and need to be provided by the CP or its agents.

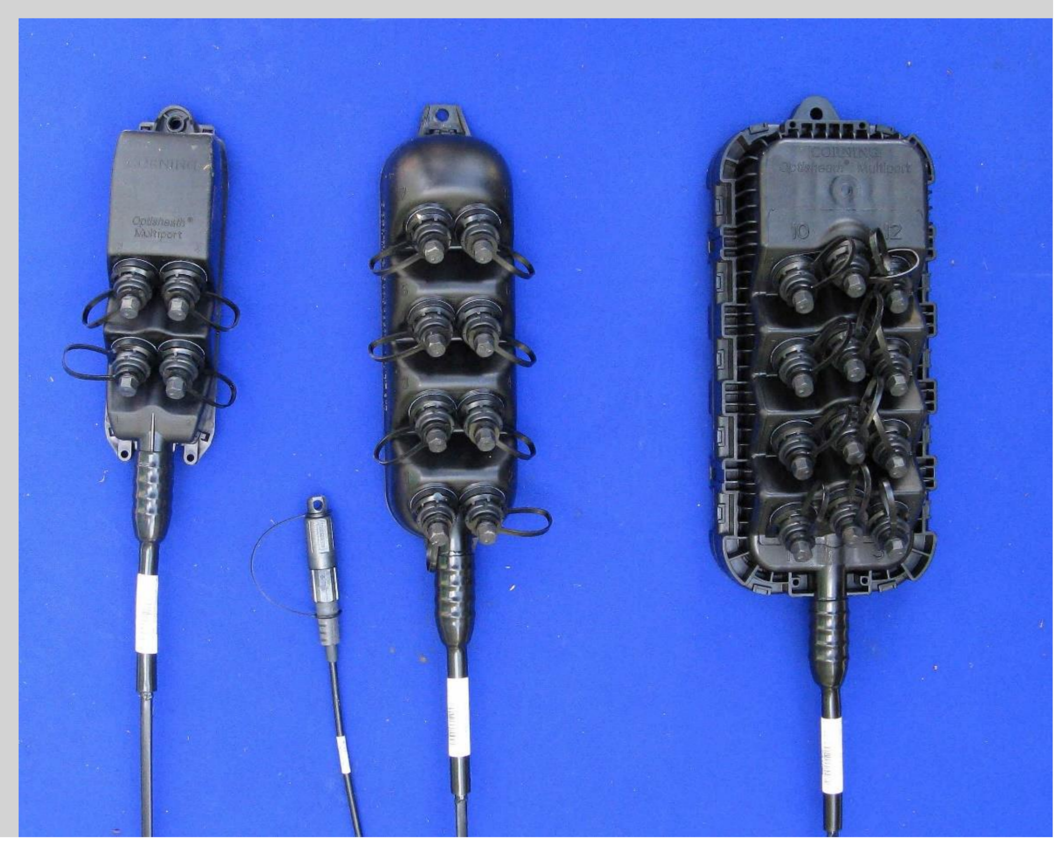

Figure 7 Connectorised Block Terminals

8.4. Connectorised Terminal Compact ('Squid' - for lamp post terminations)

For lamp post terminations, only where space is at a premium we offer a 4 port Connectorised Terminal Compact ('Squid') as a solution into the specified termination position.

The CP or its agents will need to provide the apporopriate Optitap male SC/APC patch cable to interface with Openreach equipment.

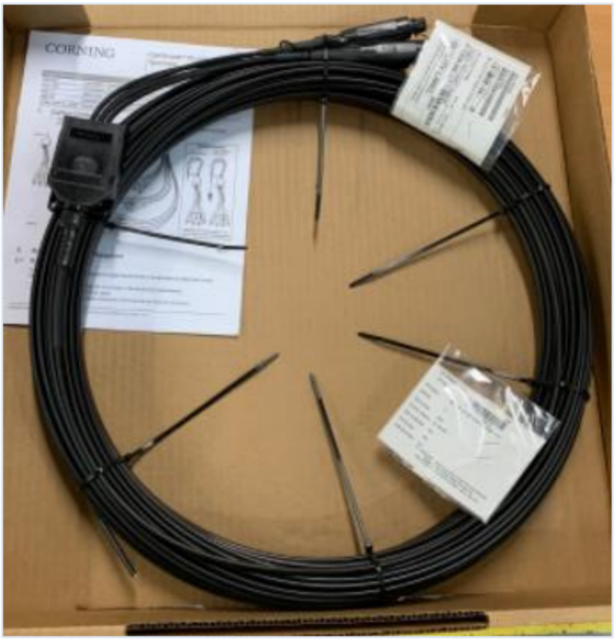

Figure 8 Connectorised Terminal Compact

9. Optical Safety

All transmission equipment connected to Openreach's network must either incorporate sufficient safety features (ALS/APR/APSD) and/or not exceed Class 1M. This ensures the maximum optical power hazard level of accessible emission that Openreach people working on the network may be exposed to is no greater than Class 1M. As per:

- IEC 60825-2 2004 Safety of laser products — Part 2: Safety of optical fibre communication systems (OFCS)

All Visual Fibre Identifiers, aka, Visible Light Sources must adhere to Class 2 laser. As per:

- IEC 60825-1 2014 Safety of Laser Products – Part 1: Equipment classification and requirements, and must not exceed an optical power of 1mW

We will expect CPs to confirm their adherence to this requirement as part of the establishment process to consume the product.

Under no circumstances should laser power levels above those defined in the terms and conditions be applied to any part of the Openreach network. Higher optical powers present a significant risk to Openreach people working on the network. Any laser power levels identified as being above the agreed safe limit will be immediately isolated from the Openreach network on safety grounds.

This may cause an interruption of service whilst an investigation takes place, and may ultimately result in Openreach terminating the service.

10. Environmental Specifications

10.1. For the Service Provided Within a Controlled Environment

- Ambient temperature: 0°C to +40°C
- Relative humidity 5% to 95%

10.2. For the Service Provided Within an External Housing

- Ambient temperature: -25°C to +55°C
- Relative humidity 8% to 95% (non-condensing)

References

For information only:

[1]	ITU-T G.652	ITU-T Characteristics of a single-mode optical fibre and cable
[2]	ITU-T G.657	ITU-T Characteristics of a single-mode optical fibre and cable
[3]	IEC 60825-1	Safety of Laser Products – Part 1: Equipment classification and requirements, and must not exceed an optical power of 1mW
[4]	IEC 60825-2	Safety of laser products — Part 2: Safety of optical fibre communication systems (OFCS)
[5]	BS EN 50377-4-2	Connector sets and interconnect components to be used in optical fibre communication systems.
[6]	ITU-T Rec. L.12	Optical fibre splices

Table 2 International Standards

11. Document History

Issue	Date	Details of Change
1.0	September 2019	First issue
2.0	December 2019	Updated with DFX State Aid Qualifying Infrastuctire information.
2.1	April 2020	Change SINet site references from http://www.btplc.com/sinet/ to https://www.openreach.co.uk/orpg/home/helpandsupport/sins/sins.do
3.0	April 2021	Updated with changes to estimated loss calculations and loss limits as well as various minor changes.
4.0	August 2021	Updated with changes to support the introduction of Dark Fibre Access.
4.1	April 2022	Removal of the pre-2000 fibre restriction
4.1	April 2023	Annual Review – branding and font changes only – issue remains unchanged.
4.2	April 2025	Openreach Registered address updated and formatting only

-DOCUMENT END-